We claim:

1. A memory cell comprising:
   (a) a magnetic element having a first segment, a second segment and a third segment for storing first, second and third remnant magnetic fields in response to a write signal, wherein each of the first, second and third remnant magnetic fields may have a first direction or a second direction, and wherein when said first, second and third remnant magnetic fields are in said first direction the memory cell is in a first orientation, and wherein when said first, second and third remnant magnetic fields are in said the memory cell is in a second orientation;
   (b) a write line for applying said write signal to said magnetic element; and
   (c) a sensor for detecting the orientation of the memory cell.

2. The memory cell of claim 1 wherein each of said first segment, second segment and third segment have an inner side and an outer side and wherein said remnant magnetic field exists in each of said first, second and third segments between said inner and outer sides.

3. The memory cell of claim 2 wherein:
   (i) when the memory cell is in said first orientation, the inner side of each of said first, second and third segments has a north magnetization and the outer side of each of said first, second and third segments has a south magnetization; and
   (ii) when the memory cell is in said second orientation, the inner side of each of said first, second and third segments has a south magnetization and the outer side of each of said first, second and third segments has a north magnetization.

4. The memory cell of claim 1 wherein:

(i) said first magnetic field has a first magnetic flux field, said second magnetic field has a second magnetic field has a second magnetic flux field and said third magnetic field has a third magnetic flux field; and

(ii) said first, second and third magnetic fields pass through a sensing region of the sensor.

5. The memory cell of claim 4 wherein the magnetic element and the sensing region are substantially parallel.

6. The memory cell of claim 5 wherein said first, second and third magnetic flux fields have components that are substantially normal to the sensing region.

7. The memory cell of claim 6 wherein said components are cumulative in at least part of said sensing region.

8. The memory cell of claim 6 wherein said components are substantially the same.

9. The memory cell of claim 1 wherein:

(i) said first magnetic field produces a first magnetic flux field, said second segment produces a second magnetic flux field and said third segment produces a third magnetic flux field;

(ii) said first, second and third magnetic flux fields pass through a sensing region of the sensor; and

(iii) the sensor is a Hall sensor and wherein the inner side of each of the first, second and third segments faces the sensing region.

10. The memory cell of claim 9 wherein the sensor is made of a material that is compliant with a CMOS process.

11. The memory cell of claim 9 wherein the sensor is made of a n-type region positioned in said substrate.

12. The memory cell of claim 9 wherein the substrate is formed of silicon and wherein the sensor is formed by doping a region of the substrate.

13. The memory cell of claim 9 wherein the sensor is made by doping said substrate with phosphorus.

14. The memory cell of claim 9 wherein a metal layer is formed between said magnetic element and said sensor.

15. The memory cell of claim 14 wherein said sensor and said metal layer form a diode for electrically isolating said magnetic element from said sensor.

16. The memory cell of claim 9 wherein the sensor has a current application line and a voltage measurement line and wherein the sensing region is defined by an intersection of said current application line and said voltage measurement line.

17. A memory cell comprising:

(a) a non-linear magnetic element; and

(b) a write line for storing a remnant magnetic field in said magnetic element.

18. The memory cell of claim 17 wherein said magnetic element has two or more segments, wherein said segments are not co-linear and wherein each of said segment stores a magnetic field.

19. The memory cell of claim 18 further comprising a sensor having a sensing region and wherein magnetic flux fields produced by each of said magnetic fields passes through said sensing region.

20. The memory cell of claim 19 wherein, in a first orientation, said magnetic flux fields pass through said sensing region in a first general direction and wherein, in a second orientation, said magnetic flux fields pass through said sensing region in a second general direction, wherein said first general direction is opposite to said second general direction.

21. The memory cell of claim 19 wherein each of said magnetic flux fields has a component that is normal to said sensing region.

22. The memory cell of claim 21 wherein, in a first orientation, said components of said magnetic flux fields pass through said sensing region in a first direction and wherein, in a second orientation, said components of said magnetic flux fields pass through said sensing region in a second direction.

23. The memory cell of claim 22 wherein said sensor is sensitive to said components of said magnetic flux fields to differentiate between said first and second orientations.

24. The memory cell of claim 23 wherein said sensor is sensitive to a cumulative effect of said components of said magnetic flux fields.

25. The memory cell of claim 17 wherein said magnetic element has two segments

26. The memory cell of claim 18 wherein said magnetic element has three segments.

27. The memory cell of claim 18 wherein said magnetic element has five segments.

28. The memory cell of claim 18 wherein said magnetic element has six segments.

29. The memory cell of claim 17 wherein at least a portion of said magnetic element is curved.

30. The memory cell of claim 29 wherein said magnetic element has a semi-circular cross-section.

31. The memory cell of claim 29 wherein said magnetic element is an incomplete toroid.

32. The memory cell of claim 29 wherein said magnetic element stores a curved magnetic field.

33. The memory cell of claim 32 further comprising a sensor having a sensing region and wherein a magnetic flux field produced by said curved magnetic field passes through said sensing region.

34. The memory cell of claim 33 wherein, in a first orientation, said magnetic flux field passes through said sensing region in a first general direction and wherein, in a second orientation, said magnetic flux field passes through said sensing region in a second general direction, wherein said first general direction is opposite to said second general direction.

35. The memory cell of claim 33 wherein said magnetic flux field has components that is parallel to a direction normal to said sensing region.

36. The memory cell of claim 21 wherein, in a first orientation, said components of said magnetic flux fields pass through said sensing region in a first direction and

wherein, in a second orientation, said components of said magnetic flux fields pass through said sensing region in a second direction.

37. The memory cell of claim 22 wherein said sensor is sensitive to said components of said magnetic flux fields to differentiate between said first and second orientations.

38. The memory cell of claim 19 wherein the magnetic element and the sensing region are substantially parallel.

39. The memory cell of claim 19 wherein:

(i) each of said magnetic flux fields passes through a sensing region of the sensor; and

(ii) the sensor is a Hall sensor.

40. The memory cell of claim 39 wherein the sensor is made of a material that is compliant with a CMOS process.

41. The memory cell of claim 39 wherein the sensor is made of a n-type region in said substrate.

42. The memory cell of claim 39 wherein the substrate is formed of silicon and wherein the sensor is formed by doping a region of the substrate.

43. The memory cell of claim 39 wherein the sensor is made by doping said substrate with phosphorus.

44. The memory cell of claim 19 wherein a metal layer is formed between said magnetic element and said sensor.

45. The memory cell of claim 44 wherein said sensor and said metal layer form a diode for electrically isolating said magnetic element from said sensor.

46. The memory cell of claim 39 wherein the sensor has a current application line and a voltage measurement line and wherein the sensing region is defined by an intersection of said current application line and said voltage measurement line.

47. A memory cell comprising:

(a) at least two magnetic elements;

(b) a sensor having a sensing region; and

(c) a write line for storing a remnant magnetic field in each of said magnetic elements, wherein, when said memory cell is in a first orientation, the magnetic field in each of said magnetic elements has a first direction with respect to said sensing region and when said memory cell is in a second orientation, the magnetic field in each of said magnetic elements has a second direction with respect to said sensing region.

48. The memory cell of claim 47 wherein, in respect of each of said elements, the first direction is opposite to said second direction.

49. The memory cell of claim 48 wherein said memory cell contains two magnetic elements.

50. The memory cell of claim 48 wherein said memory cell contains three magnetic elements.

51. The memory cell of claim 47 having first, second and third magnetic elements, and wherein said write line has:

(i) a first segment aligned with said first element;

(ii) a second segment aligned with said second element; and

(iii) a third segment aligned with said third element.

52. The memory cell of claim 51 wherein each of said magnetic elements has a rectangular cross section

53. The memory cell of claim 51 wherein said first and third magnetic elements are positioned on opposite sides of said sensing region and wherein said second magnetic element is positioned so that the magnetic elements are orthogonal to one another.

54. The memory cell of claim 51 wherein said second magnetic element has a trapezoidal cross-section and wherein said first and second magnetic elements positioned adjacent to said second magnetic element are shaped to correspond to the shape of the second magnetic element.

55. The memory cell of claim 47 wherein the magnetic element and the sensing region are substantially parallel.

56. The memory cell of claim 47 wherein:

(i) each of said magnetic fields produces a magnetic flux field that passes through a sensing region of the sensor; and

(ii) the sensor is a Hall sensor.

57. The memory cell of claim 56 wherein the sensor is made of a material that is compliant with a CMOS process.

58. The memory cell of claim 56 wherein the sensor is made of a n-type region in said substrate.

59. The memory cell of claim 56 wherein the substrate is formed of silicon and wherein the sensor is formed by doping a region of the substrate.

60. The memory cell of claim 56 wherein the sensor is made by doping said substrate with phosphorus.

61. The memory cell of claim 56 wherein a metal layer is formed between said magnetic element and said sensor.

62. The memory cell of claim 61 wherein said sensor and said metal layer form a diode for electrically isolating said magnetic element from said sensor.

63. The memory cell of claim 56 wherein the sensor has a current application line and a voltage measurement line and wherein the sensing region is defined by an intersection of said current application line and said voltage measurement line.

64. The memory cell of claim 56 wherein each of said magnetic flux fields have components that are substantially normal to the sensing region.

65. The memory cell of claim 64 wherein said components are cumulative in at least part of said sensing region.

66. A memory cell comprising:

(a) a magnetic element having a notched section;

(b) a write line adjacent to said magnetic element for storing a remnant magnetic field in said magnetic element, wherein said magnetic field may have a first orientation or a second orientation; and

(c) a sensor for detecting the orientation of said magnetic field.

67. The memory cell of claim 66 wherein said write line is geometrically linear.

68. The memory cell of claim 66 wherein said sensor has a sensing region and wherein said notched section is defined by two or more sides of said magnetic element and wherein said sides are adjacent to said sensing region.

69. The memory cell of claim 68 wherein said notched section has a trapezoidal shape defined by three sides of said magnetic element.

70. The memory cell of claim 69 wherein said magnetic field stored in said magnetic element creates a magnetic flux field passing through said sensing region.

71. The memory cell of claim 70 wherein said magnetic flux field has magnetic flux lines that emanate from each of said sides.

72. The memory cell of claim 71 wherein at least some of said magnetic flux lines emanate from said sides at an angle corresponding to the permeability gradient between said magnetic element and surrounding materials.

73. The memory cell of claim 66 wherein the magnetic element and the sensing region are substantially parallel.

74. The memory cell of claim 66 wherein the sensor is a Hall sensor.

75. The memory cell of claim 6 wherein the sensor is made of a material that is compliant with a CMOS process.

76. The memory cell of claim 66 wherein the sensor is made of a n-type region in said substrate.

77. The memory cell of claim 66 wherein the substrate is formed of silicon and wherein the sensor is formed by doping a region of the substrate.

78. The memory cell of claim 66 wherein the sensor is made by doping said substrate with phosphorus.

79. The memory cell of claim 66 wherein a metal layer is formed between said magnetic element and said sensor.

80. The memory cell of claim 79 wherein said sensor and said metal layer form a diode for electrically isolating said magnetic element from said sensor.

81. The memory cell of claim 68 wherein the sensor has a current application line and a voltage measurement line and wherein the sensing region is defined by an intersection of said current application line and said voltage measurement line.